FACULTY OF PHYSICS
UNIVERSITY OF WARSAW

See the Air

Iwona Stachlewska (stationary lidar)

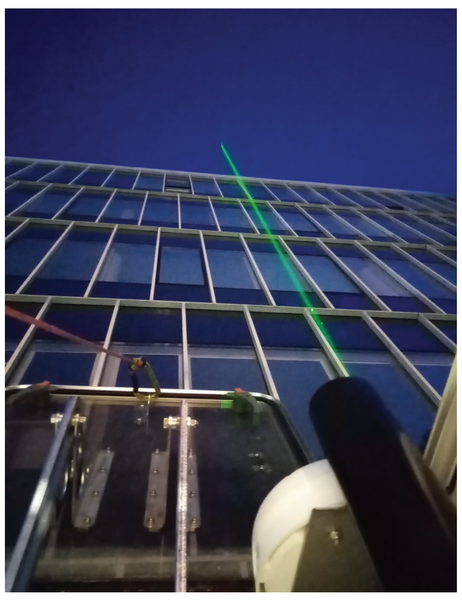
Impact of atmospheric aerosols on urban boundary layer dynamics

Atmospheric aerosols transported over long distances from different parts of the world alter the local composition of the aerosol optical properties and can affect the dynamics of the atmosphere. We have identified two important processes in this regard: if anthropogenic pollution is introduced into the urban boundary layer, it leads to an increase in particle concentration and their growth, which, in turn, promotes positive feedback on the increase of the boundary layer top. On the other hand, if biomass-burning aerosols intrude into the polluted urban boundary layer, it increases the number of absorbing particles, resulting in local warming at the top of the boundary layer and cooling at the ground. This inhibits the increase of the boundary layer top, which is prone to atmospheric stratification and air stagnation. These effects are crucial for understanding the intensifying weather changes.

Increase of dessert dust intrusions over Poland

There is a variety of evidence showing that the climate is changing rapidly. One example is the way that wind patterns are changing and climate zones are shifting. We have been using long-term lidar observations at the Warsaw Observatory Station to capture and quantify the changes in the mineral desert dust intrusions to Poland. We have found that the amount of desert dust coming from the Sahara is increasing and happening more often. The desert dust inflows also last longer and start to appear earlier in the year, even during the winter. This greatly impacts local weather conditions, making the air warmer, fostering cloud formation, and limiting precipitation. This is a crucial finding as the studied process can deepen the drought effect.

Dominika Szczepanik



Rafał Fortuna (mobile lidar)

Mobile lidar for atmospheric aerosol typing

The mobile Mie-Raman lidar was built to serve space agencies as a provider of ground truth measurements for Earth Observation Missions. The lidar mimics the existing lidars within the pan-European distributed large research infrastructure ACTRIS-ERIC. Still, it also complements them by providing additional detection channels that are unreachable by their capacities. We have implemented several extra channels, including polarization, humidity, and fluorescence observations. This gives a unique opportunity to study aerosol types and cloud formation. In different environments (urban, rural, coastal), we type aerosols (biomass burning, desert dust, continental pollution, pollen, volcanic ash, etc.) and clouds (liquid, ice, mixed-phase). We discover exotic fluorescence signals in the smog-polluted atmosphere containing high levels of elemental carbon. The signals are even higher than the fluorescence caused by the pollination of plants.

Iwona Stachlewska is an associate professor at the Faculty of Physics, University of Warsaw, the head of the Atmospheric Physics Department, and the leader of the ACTRIS National Facility in Warsaw. A well-known expert in atmospheric remote sensing, researching optical and microphysical properties of various aerosol types (anthropogenic pollution, smog, biomass burning, and pollen), as well as clouds using a wide range of lidar techniques. She builds lidars, develops data evaluation algorithms, and seeks synergies of multi-instrumental approaches combining data from different networks (EARLINET, PollyNET, CLOUDNET, AERONET, PGN, PolandAOD), models (NAAPS, DREAM, HYSPLIT, PALM), and satellites (ADM-Aeolus, Sentinels, CATS, EarthCARE).